

# **Climate change beliefs and savings behavior: a macroeconomic perspective**

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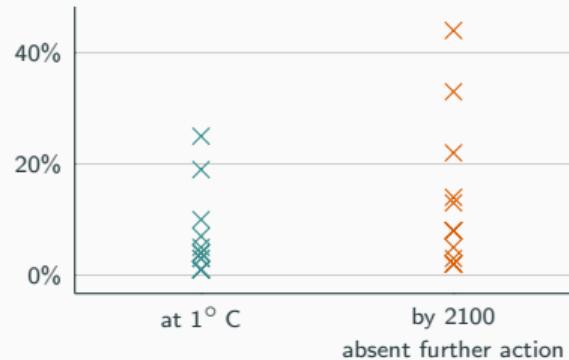
Hannah Römer

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University of Oxford

# Climate change matters: for economy

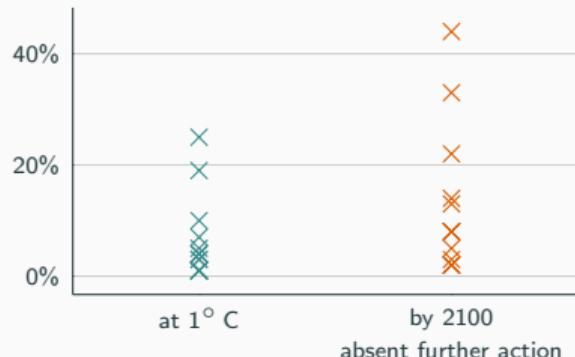
Estimated impacts of climate change  
as percentage of GDP



collected by Aerts et al (2024)  
calculations based on leading damage functions

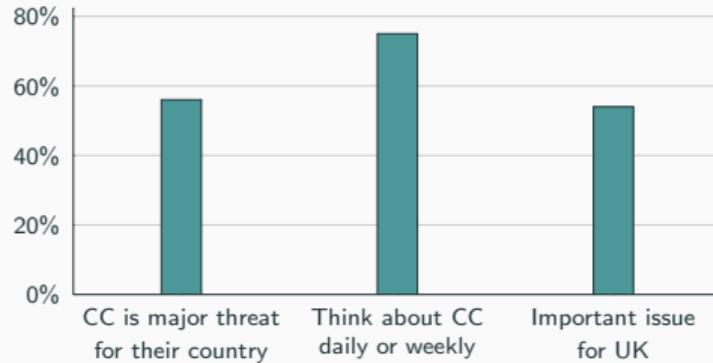
# Climate change matters: for economy and population

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as percentage of GDP



collected by Aerts et al (2024)  
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Public opinions on climate change



Shares of respondents.

Data from Pew Research (2022, 19 countries),  
Peoples Climate Vote (2024, 50 countries),  
ONS (2025, UK)

## Motivation: beliefs over climate change impacts

Climate change is a major challenge of our time.

But: Highly uncertain → subjective, diverse beliefs

Limited scope for individual actions against climate change: savings?

- + Self-insurance
- Decreasing returns, stranded assets

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What are the **macroeconomic implications** of climate change beliefs?

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### What are the macroeconomic implications of climate change beliefs?

- Do beliefs over climate change affect **individual savings**?
- Does the effect on **capital accumulation** have macroeconomic consequences? Today, in the future?
- Does **disagreement** over climate impacts matter?

## This paper: individual choices and aggregate effects

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Do climate beliefs affect individual savings?

Do climate beliefs matter for macroeconomic outcomes via capital accumulation?

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- Theoretical predictions from analytical model
- Empirical UK survey evidence: observational (representative panel), causal (online questionnaire)

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Do climate beliefs matter for macroeconomic outcomes via capital accumulation?

- Non-stationary general equilibrium model with incomplete markets and aggregate risk
  - Climate change as shift in stochastic productivity process
  - Uncertainty over trend in productivity
  - Heterogeneity in income, wealth and beliefs

## Key take-aways: climate change beliefs matter.

Climate beliefs increase individual savings both in theory and empirically...

...and affect macroeconomic outcomes during the climate transition.

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...and affect macroeconomic outcomes during the climate transition.

- **Climate concern effect:** capital ↑ output loss from climate change ↓  
NPV of output: Higher capital benefits the poor disproportionately: wealth inequality ↓  
Gini: -0.2% during transition relative to initial value
- Small but persistent impacts of disagreement:  
NPV of output: -1.5% under dispersed relative to homogenous beliefs

## Literature and contributions

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### Climate change impacts on the macroeconomy

- Stochastic damages: Golosov et al. (2014), Cai and Lontzek (2019)
- Anticipation: Bilal and Rossi-Hansberg (2023), Bakkensen and Barrage (2022)

**Contribution:** Amplified consequences of climate uncertainty in decentralized framework

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### Beliefs and disagreement over aggregate (climate) process

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**Contribution:** Implications along the transition

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**Contribution:** Implications along the transition

### Incomplete markets and aggregate risks: theory and computation

- Krusell and Smith (1998), Farhi et al. (2022), Broer et al. (2022), Fernández-Villaverde et al. (2023), Bilal (2023), Auclert et al. (2021), Moll (2024)

**Contribution:** Non-stationarity in aggregate process, global solution method

## Predictions in partial equilibrium

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Consumers allocate resources intertemporally to maximize **expected** life-time utility,  
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Two types of uncertainty affect income:

- Aggregate state: **dependent** on climate change
  - Productivity: pins down average wages and asset returns
  - Two possible states: low and high
- Idiosyncratic state: **independent** of climate change
  - Demographics: affects labor income

Model details

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**How do savings depend on beliefs over climate change?**

- How do intertemporal choices respond to changes in **probabilities** of aggregate states?
- First order response to perturbation in probability from Euler equation (cf. Farhi et al., 2022)

## First order consumption response

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An increase in  $p' = \mathbb{P}(\text{low productivity next period})$  affects consumption choice today:

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1. Concern over adverse macro risks: individual savings  $\uparrow$  in standard model
2. Opposing forces of current idiosyncratic state: large effect for poor savers

## **Empirical evidence**

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## Empirical support for theoretical predictions

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Two types of UK survey evidence:

1. Observational: large, representative UK panel survey
2. Causal: specific purpose online questionnaire

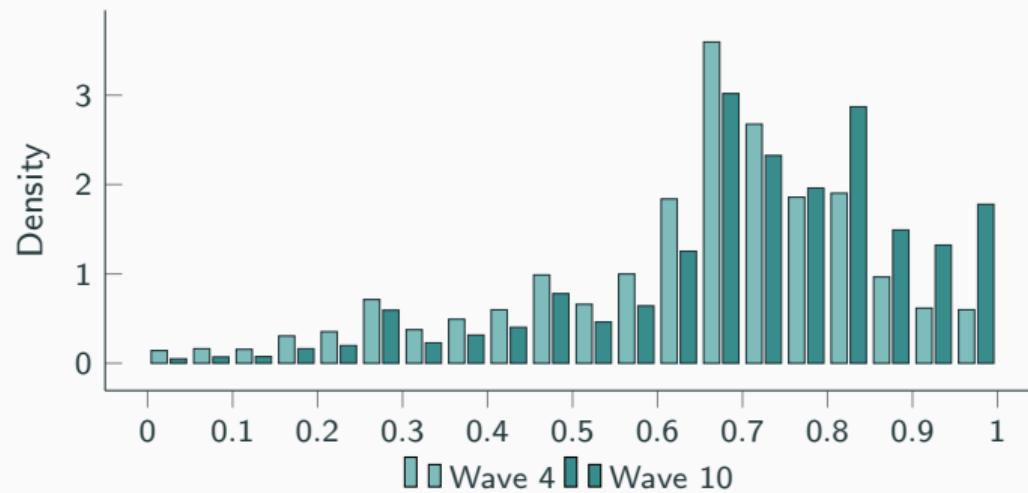
UK Longitudinal Household Survey, waves 4 and 10 (2012-13, 2018-19)

- Construct index about **climate change concern**

## Climate concern index

Five questions on beliefs over climate change, e.g.

- People in the UK will be affected by climate change in the next 30 years.
- If things continue on their current course, we will soon experience a major environmental disaster.



mean = 0.72

standard deviation = 0.22

autocorrelation = 0.53

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  - education, income, age, children, residence, flood exposure (matched)

## Observational data

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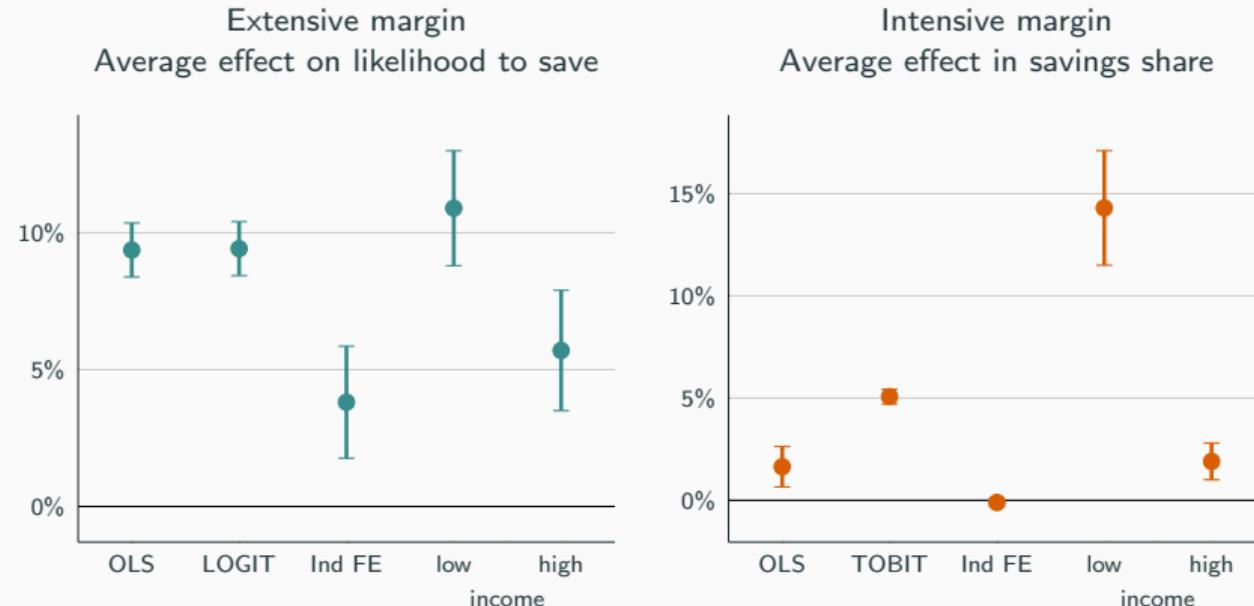
Addresses two main concerns:

1. Preferences over risk and time → Individual fixed effects
2. Idiosyncratic exposure → Flood exposure, area fixed effects

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Full sample	
$\Delta s$	7.6%***
Observations	543

Income		
low	medium	high
10.0%***	7.2%**	5.3%
178	230	81

Survey design

Sample

Questionnaire

Key take-aways:

- Passthrough of adverse aggregate risks: savings ↑ depending on idiosyncratic state
- Empirical evidence: positive relationship between climate concern and savings choices

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Open question: Do climate change beliefs matter for the macroeconomy?

- How does additional capital accumulation affect output losses during **climate transition**?
  - Does the **observed disagreement** over climate change matter for **macroeconomic outcomes**?
- Dynamic general equilibrium model

## **Dynamic general equilibrium model**

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## General equilibrium model: endogenous prices

### Households

- are subject to idiosyncratic shocks: income and life-cycle;
- consume and save to maximize EU, given budget constraint and borrowing limit.

### Representative firm

- produces using capital and labor;
- pays wages and interest;
- is subject to productivity shocks  $\zeta_t \in \{\zeta^L, \zeta^H\}$ ,  $\zeta^L < \zeta^H$ .

### Market clearing

- implies aggregate capital equals households' asset holdings.

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### Climate change

- causes exogenous and deterministic increase in global temperature  $T_t$ ;
- which is known at time  $t = 0$  and may affect the frequency of low productivity states.

→ Non-stationarity

Probability of adverse aggregate shock is given by  $\mathbb{P}(\zeta_t = \zeta^L) = p^{1-\gamma T_t}$  with **unknown** parameter  $\gamma$

- Two possible states of the world:  $\gamma \in \{0, \bar{\gamma}\}$
- Individual initial belief  $\pi_{it} = \mathbb{P}_{i0}(\gamma = \bar{\gamma})$
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Impacts modeled via **probability**, levels stay constant

- Any draw  $\{\zeta_t\}_t$  possible under all beliefs
- Implicit level effect

## Consumer problem

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Aggregate capital is both **endogenous outcome** and **input for decision** of forward looking consumer.

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**Assumption: bounded rationality**

Decisions are based on Perceived Law of Motion (PLM)

$$K' = \mathcal{H}(K; \mathcal{X}) \quad \text{for some explanatory variables } \mathcal{X}.$$

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**How to choose PLM?**

1. Find self-justified equilibrium to approximate rational expectations (Krusell and Smith, 1998)  
→ extend idea to non-stationary framework
2. Alternative: adaptive expectations with varying degree of memory dependence  
→ addresses critique by Moll (2024)

For period  $t$ :  $\Psi_t$  distribution of agents over demographics, asset holdings and beliefs.

## Dynamic equilibrium

For a given draw  $\{\zeta_t\}_t$ , initial distribution  $\Psi_0$  and PLM  $\mathcal{H}$ , the *dynamic equilibrium* of the economy is given by a sequence of distributions  $\{\Psi_t\}_{t \geq 0}$  so that:

1. Each period, households and firms optimize given their beliefs; markets clear.
2.  $\Psi_t$  evolves according to (i) demographic dynamics, (ii) savings choices, and (iii) Bayes' formula.

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## Summary statistics

- Stochastic steady state
- Ensemble averages

## Solution algorithm: PLM estimation

Fix some functional form

- Obvious candidates for  $\mathcal{X}$ : shock  $\zeta$ , temperature  $T$ , personal belief  $\pi$
- Guess for  $\mathcal{H}$ 
  - linear in  $\pi \rightarrow$  estimate only for  $\pi \in \{0, 1\}$

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Generate simulated data

- Non-stationarity: **ensemble** of shock sequences
  - Stratified sample: Match theoretical mean and variance within each period

Iterate on parameters until convergence.

Stratification procedure

Model selection

Adaptive expectations with memory

Model performance

Heterogeneity in forecasts

Calibration

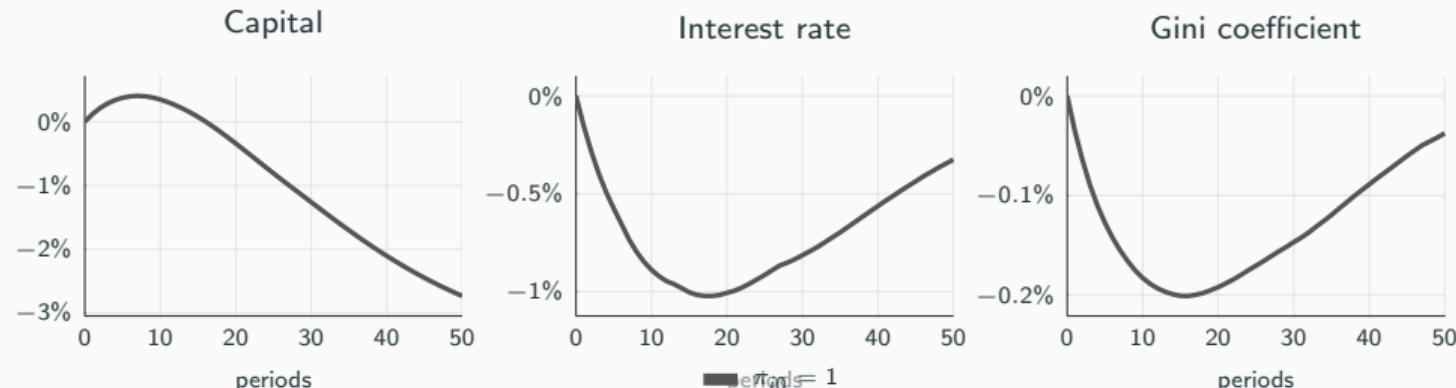
## **Macroeconomic effects of climate beliefs**

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# The climate transition

Baseline:  $\bar{\gamma} = \gamma$

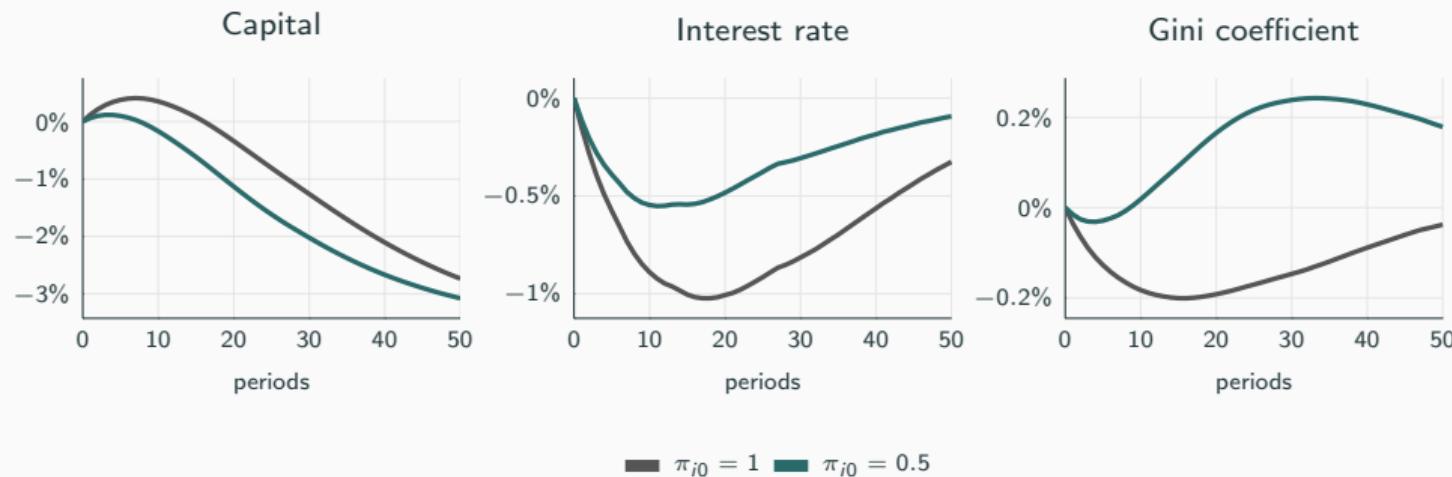
How does the climate transition affect the macroeconomy if everyone expects productivity impacts?



Ensemble averages over time, relative to initial SSS

# The role of beliefs during the climate transition

Capital ↓ if population assumes 50% chance of no productivity impacts  
→ wealth inequality rises



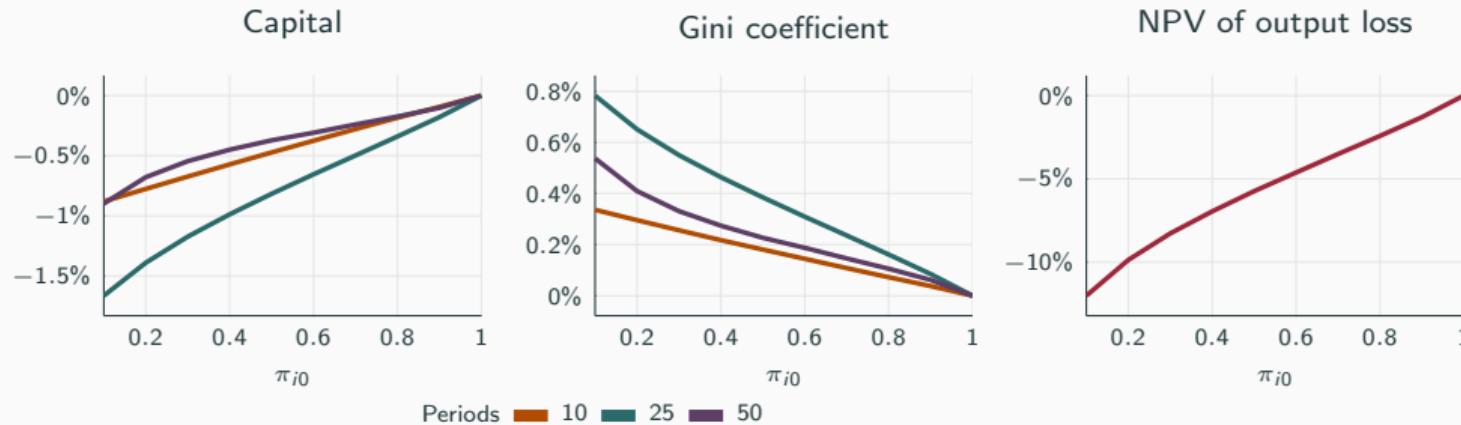
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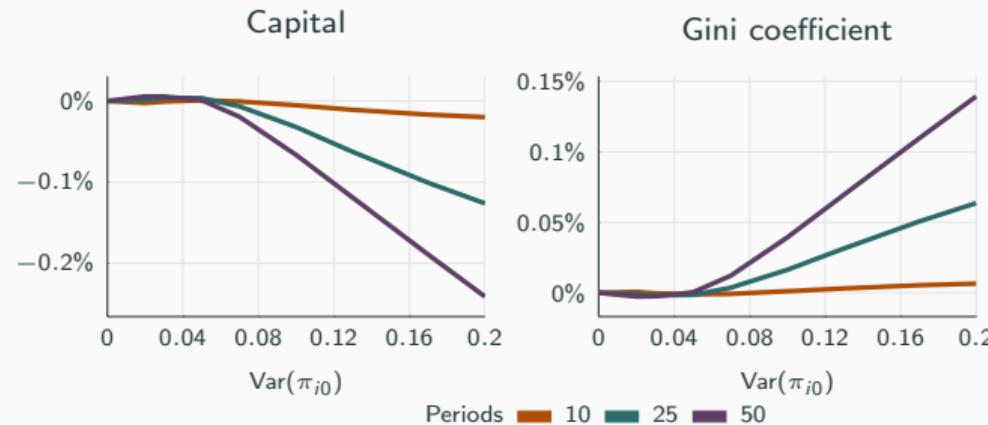
Relative deviation to  $\pi_{i0} = 1$ , no belief heterogeneity

## The role of beliefs during the climate transition



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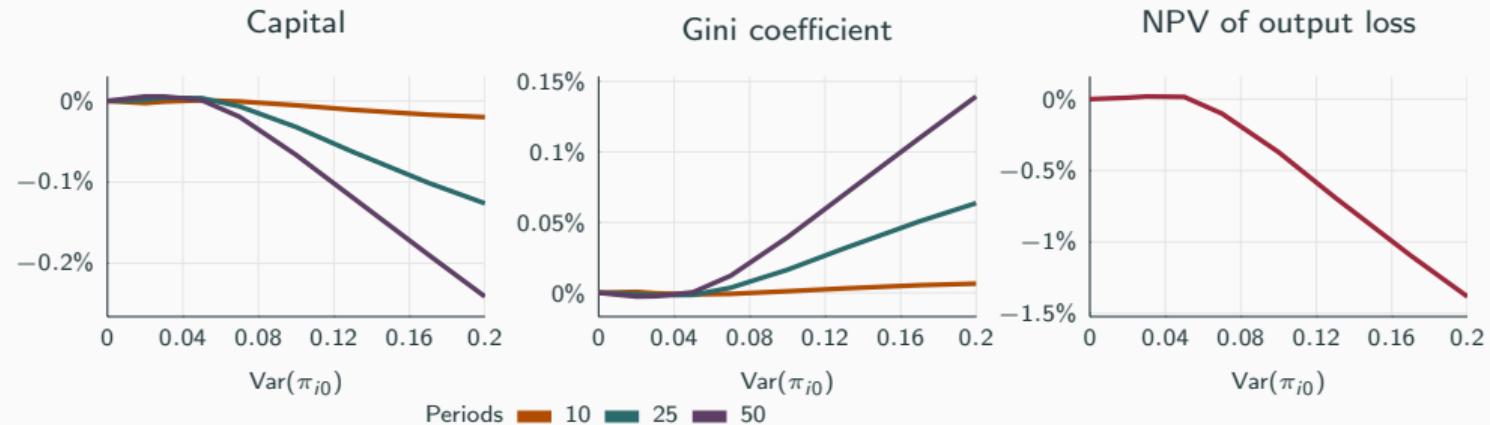
## The effects of belief dispersion



Relative deviation to  $\text{Var}(\pi_{i0}) = 0$  at  $\mathbb{E}(\pi_{i0}) = 0.7$ .

- Capital  $\downarrow$  Gini  $\uparrow$  under mean-preserving spread
- Persistent: deviation rises even after 25 years
- Small effects compared to variation in first moment

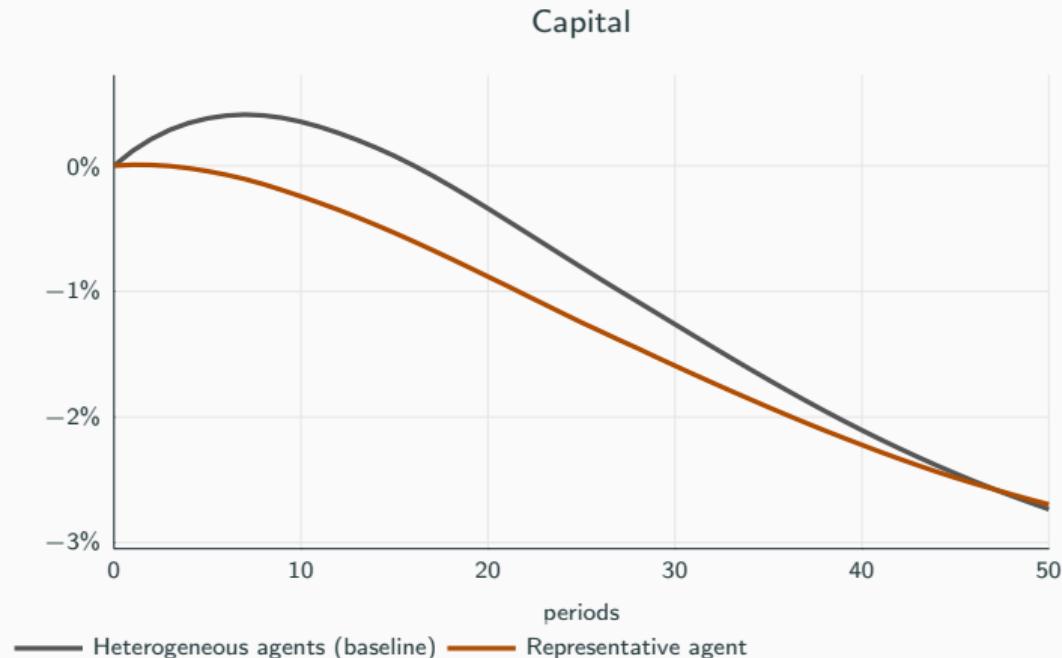
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## Mechanisms: the role of incomplete markets



Relative deviation to initial SSS

### Additional results

- Climate change deniers  $\pi_{i0} = 0 \rightarrow$  endogenous polarization
- Alternative true model  $\gamma \rightarrow$  asymmetric effects
- Welfare analysis  $\rightarrow$  gains for future generations

### Robustness

- Alternative PLM: memory matters

# Beliefs over climate change matter.

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## Individual behavior

- Climate concern increases individual savings in model of aggregate climate damages
- Consistent with UK survey evidence

## Aggregate and distributional effects

- Climate concern effect: capital increases in short-run, attenuates climate damages
- Heterogeneous impacts: wealth inequality ↓
- Disagreement: small but persistent role

## Beliefs over aggregate risks in incomplete markets

- Development and solution of non-stationary model
- Applicable to range of questions on uncertainty and disagreement over structural shifts

## References

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- Andre, P., Flynn, J. P., Nikolakoudis, G. and Sastry, K. (2025), 'Quick-fixing: Near-rationality in consumption and savings behavior', *NBER Working Paper Series* .
- Auclert, A., Bardóczy, B., Rognlie, M. and Straub, L. (2021), 'Using the sequence-space jacobian to solve and estimate heterogeneous-agent models', *Econometrica* **89**, 2375–2408.
- Bakkensen, L. A. and Barrage, L. (2022), 'Going underwater? flood risk belief heterogeneity and coastal home price dynamics', *The Review of Financial Studies* **35**, 3666–3709.  
**URL:** <https://doi.org/10.1093/rfs/hhab122>
- Bakkensen, L., Phan, T. and Wong, T.-N. (2023), 'Leveraging the disagreement on climate change: Theory and evidence', *Federal Reserve Bank of Richmond Working Papers* **23**, 1–75.
- Bilal, A. (2023), 'Solving heterogeneous agent models with the master equation', *NBER Working Paper Series* .
- Bilal, A. and Käenzig, D. (2024), *The Macroeconomic Impact of Climate Change: Global vs. Local Temperature*, National Bureau of Economic Research.

Bilal, A. and Rossi-Hansberg, E. (2023), Anticipating climate change across the united states, Technical report, National Bureau of Economic Research.

**URL:** <http://www.nber.org/papers/w31323>

Broer, T., Kohlhas, A., Mitman, K. and Schlafmann, K. (2022), 'Expectation and wealth heterogeneity in the macroeconomy', *CEPR Discussion Paper* .

Burke, M., Hsiang, S. M. and Miguel, E. (2015), 'Global non-linear effect of temperature on economic production', *Nature (London)* **527**, 235–239.

Cai, Y. and Lontzek, T. S. (2019), 'The social cost of carbon with economic and climate risks', *Journal of Political Economy* **127**, 2684–2734.

Chen, H., Joslin, S. and Tran, N.-K. (2012), 'Rare disasters and risk sharing with heterogeneous beliefs', *The Review of Financial Studies* **25**, 2189–2224.

**URL:** <https://doi.org/10.1093/rfs/hhs064>

Farhi, E., Olivi, H. A. and Werning, I. (2022), Price theory for incomplete markets \*, Technical report.

Fernández-Villaverde, J., Hurtado, S. and Nuño, G. (2023), 'Financial frictions and the wealth distribution', *Econometrica* **91**, 869–901.

Golosov, M., Hassler, J., Krusell, P. and Tsyvinski, A. (2014), 'Optimal taxes on fossil fuel in general equilibrium', *Econometrica* **82**, 41–88.

**URL:** <https://onlinelibrary.wiley.com/doi/abs/10.3982/ECTA10217>

Hong, H., Wang, N. and Yang, J. (2023), 'Mitigating disaster risks in the age of climate change', *Econometrica* **91**, 1763–1802.

Krusell, P. and Smith, A. A. J. (1998), 'Income and wealth heterogeneity in the macroeconomy', *Journal of Political Economy* **106**, 867–896.

**URL:** <http://www.jstor.org/stable/10.1086/250034>

Lontzek, T., Pohl, W., Schmedders, K., Thalhammer, M., Wilms, O., Allard, A.-F., Bansal, R., Branger, N., Fama, E., Fabisik, K., Gao, C., Hansen, L. P., Judd, K. L., Koijen, R., Nagel, S., Pflueger, C., Pouget, S., Rossi-Hansberg, E., Schneider, C. and Whelan, P. (2024), Asset pricing with disagreement about climate risks \*, Technical report.

Moll, B. (2024), The trouble with rational expectations in heterogeneous agent models: A challenge for macroeconomics.

Rising, J., Dietz, S., Dumas, M., Khurana, R., Kikstra, J., Lenton, T., Linsenmeier, M., Smith, C., Taylor, C. and Ward, B. (2022), What will climate change cost the uk? risks, impacts and mitigation for the net-zero transition, Technical report, Grantham Research Institute on Climate Change and the Environment, London School of Economics and Political Science.

Earnings and life-cycle:

- AR(1) process for skills estimated on UK panel data
- Expected duration working life (retirement): 40 (20) years; replacement rate 60%

Aggregate shocks: Effect of climate change on UK productivity

- AR(1) process for temperature, long-run increase of 0.9 deg within 75 years.
- Meta study Rising et al. (2022) estimates output losses:

1.1% in 2022, 3.3% by 2050, 7.4% by 2100

- Bad states  $p_0 = 0.15$ ,  $\zeta^L = 0.93$ :

$$\mathbb{E}(\zeta_0) = 0.9895, \mathbb{E}(\zeta_{100}) = 0.965$$